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STATE OF MARYLAND

STATE PLANNING COMMISSION

TEN-YEAR HIGHWAY CONSTRUCTION PROGRAM

for

MARYLAND

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March
1935

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Maryland. State Planning Commission

STATE OF MARYLAND

STATE PLANNING COMMISSION

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TEN-YEAR HIGHWAY CONSTRUCTION PROGRAM

for

MARYLAND

by

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Published through the courtesy of the
Maryland State Roads Commission
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INTRODUCTORY STATEMENT

The State Planning Commission of Maryland presents herewith its third report on important problems of the State of Maryland in accordance with the powers and duties delegated to it under an Act of the Special Session of the Legislative Assembly of Maryland of November, 1933.

This report deals with the highly important subject of advanced planning of highways and presents a program of proposed construction and other activities to be carried on by the State Roads Commission during the ten-year period 1935-1945. The State Planning Commission acknowledges herewith the cooperative effort of a sub-committee appointed by it to consider highway problems. The membership of the sub-committee is listed herein.

The report presents a historical review and a statement as to the need for a long-term plan to govern the orderly construction of highways during the next decade for the purpose of providing an adequate, safe and efficient system of arterial highways for the State. It presents a discussion of the factors affecting location and design of highways and suggestions as to methods for estimating lines of flow and volumes of existing and of anticipated future traffic. A discussion of the highly important problems of right of way is presented, including the methods of acquisition, the desirability of long-range program to provide acquisitions well in advance of

construction, minimum widths, rules governing use, and beautification. A full section is devoted to standards of design and, finally, there is presented a program of proposed construction, which includes improvement of existing routes, construction of new routes, construction and reconstruction of bridges, and the construction of railroad grade crossing eliminations.

This report does not include any discussion of the estimated cost of the construction program proposed, nor of methods for financing the cost of the program. These subjects will be fully dealt with in a subsequent report.

ABEL WOLMAN, Chairman
State Planning Commission

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I. HISTORICAL REVIEW

The State of Maryland was one of the first in the United States to recognize the construction of highways as a state function. In 1898, when the automobile was still an experiment, the Legislature appropriated $10,000 annually to the Maryland Geological Survey for the purpose of conducting highway investigations and of giving advice to the various counties in regard to highway problems. Public interest at that time was being directed toward highway construction and in the report of the Geological Survey, published in 1899, the following statement was made:

> "No subject today more demands the attention of the people of Maryland than that of road construction. When hundreds of thousands of dollars are being annually appropriated for our highways, it is pertinent to inquire whether this outlay is intelligently made, and if not, whether better methods of road construction cannot be adopted, in order that the people of the State may secure a larger return for the money which they expend."

The same inquiry regarding the intelligent outlay of funds is even more appropriate today, because of the automobile, than it was in this initial Maryland Road Report, especially if the word "location" is added to precede the word "construction."

During these early days of road development, only advice was furnished by the Geological Survey. In 1904, the Legislature passed the first act appropriating state funds for highway construction purposes. Funds were made available to the counties on the stipulation that the counties should match them with local money.

By 1908, when the automobile had begun to establish its importance as a means of transportation, the thought of a coordinated system of state highways had progressed to such an extent that the Legislature that year established a State Roads Commission. The first duty of the new Commission was to select and build a state system of main roads. In carrying this into execution, the Commission sought advice of the people of the state; public hearings were held in every county and in Baltimore City, and citizens were requested to appear at these hearings and present their views as to the roads to be improved. Based on the recommendations of these local groups, approximately 1,200 miles of roads were designated as the State Roads System. Generally, these roads connected the various county seats with each other and with Baltimore City. The Commission also began negotiation for the purchase of a number of private turnpikes which had been constructed and maintained on a toll basis. By the end of 1915, there had been constructed under the State Roads Commission, or purchased from the turnpike companies, approximately 220 miles of road at a cost of $665,000, or approximately $3,000 per mile. Due to the type of surfacing materials used on these roads, little remains of them today, except the rights of way, and in many cases these are entirely inadequate in width and alignment for present-day traffic. It should be noted in defense of this situation that even as recently as 1915, few people had any vision of the future tremendous growth of highway transportation.

It appears from the records that the early activities of the State Roads Commission consisted in an improvement of existing wagon roads and not in the planning or laying out of a highway system on the basis of any anticipated traffic volumes and lines of flow. With minor revisions in detail, this policy of improving previously existing roads by applying durable surfacings and in some instances increasing widths, is even up to the present time the dominating influence in programming construction.

Due to continuing recognition by the Commission of the demands of sectional groups for extensions to the state system, no adequate revision of location and construction of the obsolete main routes has ever been made. Consequently, while the quality, both of design and materials, on new construction, has steadily improved, the State Roads System, during this same time, has been extended over less heavily traveled routes. Due to this progressive improvement in construction and to the lack of planned improvement of the original primary system, Maryland roads today present an inverted structure. The primary heavily traveled system, generally speaking, is inadequate as compared with the lightly traveled secondary system. The greater volume of traffic, however, is carried principally on the primary system and uses the far superior secondary roads only to a minor degree.

II. NEED FOR LONG-TERM PLAN

The foregoing brief history forces recognition of the need for a comprehensive state-wide, long-term plan for highway development in Maryland. This plan should not be influenced by sectional interests, whose primary concern is always local, rather than state. Its development must be effected by the improvement of properly selected existing routes, together with the location and construction of new routes. A start has already been made on such a program in the construction of the relocated Philadelphia Road, between Baltimore and Havre de Grace, the Bel Air Road (U. S. Route 1) between Baltimore and Bel Air, and through the beginning of the improvement to the Baltimore-Annapolis Boulevard. Traffic counts made by the State Roads Commission indicate, however, a large mileage of roads still in urgent need of re-aligning and widening, in order to carry with safety the traffic using them today. Obviously, such improvements should be accomplished as promptly as possible. Roads selected for re-alignment and reconstruction should be limited to those which fit into the planned arterial system until such time as this system is complete.

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Evidences of the wastefulness of constructing or rebuilding roads without such long-time planning in mind are abundant. Examples of this may be found in the construction of the Defense Highway, U. S. Route 50, between Washington and Annapolis, during the years

1920 to 1926, along alignment and width adequate for the traffic than using this route, but overlooking the fact that once the road was improved, there would be a large increase in traffic between these two points. Almost immediately after construction, the road was found to be exceedingly unsafe for the volume of traffic which took advantage of it and required widening within four years after the original construction. In the widening of the Baltimore-Washington Boulevard from two to four lanes, future growth of traffic was not fully anticipated and within three years after the original widening, it was found necessary to relocate several curves in order to prevent repeated accidents at these points. The improvement of the Baltimore-Philadelphia Road, U. S. Route 40, originally paved with concrete 14 and 15 feet wide, later widened to 17 and 18 feet, and still later practically abandoned for a new location, is a further example of the waste incident to lack of sufficient vision in laying out a State Highway System. Similar examples might be cited in other portions of the state. The next ten years can be spent most profitably by adhering to a planned program of construction, the principal purpose of which shall be to bring the existing arterial highway system of Maryland to a state of maximum efficiency and safety.

In laying out certain types of engineering projects, it is

necessary to take into account only natural factors, such as topography, soil conditions, drainage areas, etc. In planning a system of highway transportation, however, there are, in addition to the above factors, others which are dependent on human progress and which are of equal, if not greater, importance. These include the probability of future development, industrial or commercial in certain sections, changing modes of transportation and other economic factors, perhaps as yet unrecognized. Consequently, no plan for a highway system can ever be said to be complete and final. It may be correct as of a given date, and serve adequately as a chart for the future, but no one can guarantee that it will remain correct in all its details under some new condition. It is essential, therefore, in developing a state plan, such as is suggested in this report, that provision be made for <u>continued</u> advance planning. The State Roads Commission is the logical body to provide for such advance planning and it is recommended that definite provision be made in the State Roads Commission organization for directing and continuing analysis of traffic trends, economic growth, transportation developments, etc., to the end that at all times the improvement of highways may be based on a plan which at that time is anticipating future conditions as accurately as possible.

III. FACTORS AFFECTING LOCATION AND DESIGN

The location and design of a system of new highways or the improvement of existing highways should be materially influenced by the probable future development of the state, by the highway plans of adjoining states and of the Federal Government, and by the plans for National defense.

The future economic development of Maryland will in all probability be primarily along commercial and industrial lines, rather than agricultural.

There are sections of the state that obviously lend themselves more readily than others to industrial and commercial development; for example, the region lying between the Chesapeake Bay and the existing Philadelphia Road, U. S. Route 40; the region south and west of the Patapsco River; the Potomac River Valley, in the vicinity of Cumberland; and to a lesser degree, the areas surrounding the larger towns. The commercial and industrial development of these regions will ultimately lead to the development of residential areas in their immediate vicinity. The nature and extent of such commercial, industrial and residential regions will have a material effect upon state highway needs. Therefore, studies should be made for the purpose of anticipating so far as possible their character and extent.

Seashore resorts, resorts on the shores of the Chesapeake Bay, and summer residential developments along the rivers and in the mountains of Maryland, are also factors that must be given careful and serious consideration in the planning of the arterial highway system. Among the more important of these are the seashore resorts along the Atlantic Coast in Maryland and also in Delaware, recreational and summer cottage developments along the Chesapeake Bay, and the summer residential developments centering on the Severn and Magothy Rivers. Mountain resorts in the western part of the state should also be included. All such regions are productive of large volumes of seasonal traffic movement, if made easily accessible. In estimating the volume of such traffic and in planning for roads leading to these regions, it should be carefully observed that the provision of convenient, safe and quick access to them will greatly stimulate increase in their growth, followed by corresponding increases in the traffic on the roads serving them.

Agricultural and rural development in all likelihood will be of secondary importance insofar as the development of the Highway System is concerned. Generally speaking, these agricultural and rural sections are fairly well provided with roads at the present time.

It is obvious that any highway plan for the State of Maryland should give consideration to plans of the Federal Government for routes of national importance and also to the plans of adjoining states, in order that Maryland's construction program may be properly coordinated with these states.

There are certain highways that must of necessity be important to the War Department in its plans for National defense. Maryland contains a number of agencies of the War Department, such as the Aberdeen Proving Ground, Edgewood Arsenal, Fort Hoyle, Camp Holabird, Fort Howard and Fort George G. Meade. In the preparation of a program of highway construction, therefore, the views of the War Department concerning certain highways have been obtained, and are reflected in the recommendations of Section VII.

IV. ESTIMATE OF TRAFFIC

1. Volume

For many years, the Maryland State Roads Commission has engaged in systematic and extensive traffic count surveys and through the development of such information has a complete record of the traffic flow on the existing highway system. Such information is important and valuable as a basis for determining traffic flow over proposed improvements on existing routes. It is not in itself a measure, however, of future traffic flow. As an example of this there may be cited the Baltimore-Washington Boulevard, which in 1928, before the widening to four lanes, carried an average daily traffic of 5,274 vehicles, which was sufficient to justify its widening from two to four lanes. By the time the widening had been completed in 1931, however, the average daily traffic had increased to 10,006 vehicles, with a peak traffic in excess of 27,000 vehicles. Had this large increase in traffic which developed immediately upon the completion of the improvement been visualized, it would have been apparent that an entire new road, constructed along modern alignment and grade, and with right of way sufficiently wide to prevent encroachment, would have been a more economical solution of the problem and would have provided a highway of far greater convenience and safety than that which resulted from merely widening the existing line.

The present-day traffic flow on any road can be taken only as one indication in determining the probable traffic flow over that road, after improvements have been made, since the provision of adequate facilities tends to develop additional traffic. In all highway construction, consequently, it is felt essential that volume studies be made, not only of the existing traffic, but of the potential traffic, based on population served and probable stimulating effect of the proposed improvement.

Other factors which should also be considered in estimating traffic volume are trend in population growth, motor vehicle registration in relation to population, motor fuel consumption, and the probable economic development of local areas. The population of Maryland increased 9% between 1900 and 1910; 11.3% between 1910 and 1920; 12.5% between 1920 and 1930. It does not seem likely that the rate of growth will continue to increase, but to the contrary that the rate of increase will become less, due to restriction of immigration and declining birth rate. It seems fair to estimate that the growth between 1930 and 1940 will approximate 12%. Based on Maryland population and registration statistics, motor vehicle registration in relation to population increased from one vehicle to 288 people in 1910; to one vehicle to 14 people in 1920; and to one vehicle to 4.9 people in 1930. It seems reasonable to assume

that this factor will be further reduced in the next ten years. The consumption of motor fuel has been found, on comparing its growth with traffic counts, made on the State Roads System, to parallel closely the actual volume of traffic. Gasoline consumption could, therefore, be used as an index of general traffic flow and the curve of motor fuel consumption might be projected, in order to anticipate future use of motor fuel, and, consequently, anticipated traffic.

Future developments in engine design, possible price changes of motor fuels, growth of highway freight movement, etc., are likely to affect the relationship between motor fuel and traffic to such an extent that the past relationship will no longer hold. It does not appear possible, consequently, to make an accurate forecast of the intensity of future traffic. Consideration of the factors noted above indicates clearly, however, that there is every prospect for a substantial further increase in traffic.

2. Location of Lines of Flow

A State Highway System and the transportation industry which it makes possible may be likened to a water-distribution system. The adequate design of such a system involves the provision of carrying capacity, sufficient for the greatest anticipated requirement and so located as to involve the minimum distances practicable. Traffic flow studies on the existing State Roads System indicate clearly that in some cases large volumes of traffic are forcing them-

selves over narrow and inadequate roads, while roads of more adequate width, running in the same general direction, are relatively lightly used. For example, two main routes exist between Baltimore and Philadelphia, U. S. Routes 1 and 40. Although these two roads are in general of similar alignment and grade, Route 1 carries only about one-half as much traffic as Route 40, since it is not located so near the line of natural traffic flow as Route 40.

It would be interesting to know what saving of life and property, investment of funds, and in operating costs of motor vehicles, would have resulted if, at the time that the need for additional traffic-carrying capacity between Wilmington and Baltimore became evident, studies of future traffic volume, and location of traffic flow lines, had been made and had culminated in the selection of an entirely new line of development, such as the new Philadelphia Road now under construction, rather than making any appreciable investment other than ordinary maintenance, in either of the existing routes, namely, number 1 or number 40.

3. Necessity for Continuous Traffic Studies

Too great stress cannot be laid on the necessity for continuing comprehensive traffic studies by the State Roads Commission. They are not only an essential basis for such forecasting as is mentioned above, but they serve as a useful, continuous, check in indicating desirable revisions in carrying out the construction of any

long-range program. The traffic counts carried out in the past by the State Roads Commission have consisted, with the exception of three brief project surveys, in a simple numerical count of the number of vehicles passing a given spot. Such information would be much more effective as a basis for road location and design, if it also carried origin and destination data, and data pertaining to motor vehicle use, especially trucks. Provision should be made in future State Roads Commission traffic studies to obtain this additional information, in order that the results may be of maximum use in the design of highways.

V. RIGHT OF WAY

The acquisition of right of way must be regarded as one of the most important functions of the Commission, for no construction can be properly commenced until the land upon which it is to rest is either owned by the state or is under its permanent control. Failure to secure rights of way well in advance of the award of contracts inevitably results in increased cost of the property to the state and may result in increased cost of construction if contractors include in their bids additional amounts as safety factors to cover increased costs to which they may be subjected by delay in starting the work or by interruption after the work has been commenced.

In the early days of State Roads construction, it was the custom to acquire rights of way by easement. During 1933, it was decided that such easements were not satisfactory. Therefore, the policy of obtaining a fee simple deed to all rights of way was instituted. Whenever possible, titles are acquired by negotiation and purchase. This is always the most satisfactory method. If this method fails, condemnation must be resorted to. Under existing Maryland Law, property can be obtained by condemnation, if agressively prosecuted, within approximately two months from the time when proceedings are instituted. Although the property owner has the right of appeal from the original decision resulting from condemnation proceedings,

commencement of the work of construction on the property involved need not be delayed by such an appeal. It appears, therefore, that the agressive use of laws now in existence will result in the orderly and satisfactory acquisition of right of way. This means the necessity for continued advanced planning and the establishment of locations for improvement of existing routes and for new construction, so that the location where rights of way will be needed will be known well in advance of the time when construction is to be commenced. It also indicates the necessity for continuing a well-trained and agressive Rights of Way Department, including the full-time services of a competent legal advisor, all operating under the direction of the Chief Engineer.

If agressive prosecution under existing laws fails to produce the desired results and if there appears a growing public sentiment in favor of some change, it may be found advisable to give consideration to the method used by more than half of the other states. Briefly, their procedure provides for filing by the road authorities, either in their own name or through the county or other agency in which the property to be taken lies, of a petition in the appropriate court for condemnation of the land required. The court then appoints disinterested appraisers, usually three in number, who are charged with the duty of fairly appraising the damages and benefits that will accrue to owners of the property in question. The Highway Commission then

deposits with the Clerk of the Court the net amount of damages found by the appraisers and thereafter the Highway Commission may enter upon the land and commence construction of the work.

Either party may appeal from the findings of the appraisers and carry the appeal through the courts. The work of construction, however, is not prevented from starting nor is it subsequently interrupted by this procedure.

Where traffic studies as described under Section IV indicate the eventual necessity for development of important routes along new lines, provision should be made for the acquisition at least of control of sufficient right of way for the construction of the road, well in advance of the time when it may be anticipated that actual construction will be commenced. Such control might be obtained initially by means of long-term options.

Past experience has indicated the necessity of generous rights-of-way widths for highway purposes. Proper provision in this respect accomplishes a number of highly desirable ends. First, it provides space for future widening, without involving the destruction of roadside buildings and other improvements which invariably are the most valuable element of abutting property. Second, it prevents the encroachment of roadside structures, such as filling stations, refreshment stands, etc., on the traveled way, and thereby avoids inconvenience and danger to the traveling public. Third, it provides the

possibility for wide earth shoulders, so that vehicles may pull completely off of the paved surface to park. Lack of such earth shoulders has been the cause of many serious and some fatal accidents in Maryland. Fourth, such width would avoid the growth of dense underbrush, hedge fences, etc., immediately adjacent to the road metal. Growth of this sort has been a major factor in drifting of snow, causing many roads to be closed at times of heavy snowfall and costing many thousands of dollars through the need for extra equipment and labor to clear such roads.

Suitable and uniform regulations should be adopted to control the use by adjacent property owners of rights of way, not actually involved in the highway. Particularly in heavily traveled sections, there is a tendency for property owners to encroach on the rights of way with temporary structures and also to build entrance lanes, erect letter boxes, etc., at points offering a hazard to traffic. These activities could be regulated to the great benefit of the general public and without causing hardship to individuals.

Associated with the control of the highway proper, it seems highly essential that on certain roads at least consideration be given to the control of roadside structures off the right of way. A number of different schemes have been tried in various parts of the United States in an effort to control such adjacent property,

and one of the most successful methods so far developed is the parkway plan, which has been brought to a highly effective stage in New York State, notably in Westchester County and on Long Island. An appendix outlining the organization and accomplishments in New York is attached to this report.

The Bill Board Act of 1931 marked the beginning of any consideration for the appearance of highways in Maryland. This law provides for the licensing of bill board advertisers and for the issuing of individual permits for bill boards, at a nominal cost seldom in excess of $1.00, and makes available for highway beautification the insignificant net revenue from the enforcement of the law. This law has failed to cause the removal of large bill boards from the highways, which the proponents of the law hoped that it would accomplish. Of the approximately 30,000 illegal signs destroyed by the State Roads Commission in its enforcement of the act, none were of the large and unsightly type. Practically all of this type are maintained by commercial advertising firms, to whom the nominal fee is of little or no importance. The slight revenue derived from the act has been used in roadside planting; but obviously can make no visible impression on an entire state highway system. It seems desirable, therefore, that on future construction work, adequate provision be made for preventing erection of bill boards and for preserving scenic features, including the constructing of earthwork

in such a manner as to leave slopes on both cuts and fills, which are capable of supporting plant life and which will remain stable without washing into unsightly gullies and ravines. The beautiful work which has been done along these lines in Westchester County, New York, and also along the Mt. Vernon-Memorial Highway in Virginia, indicates that at slight expenditure a newly constructed highway may be given a permanently attractive appearance.

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VI. STANDARDS OF DESIGN

1. Types

One of the fundamental problems to be solved for each highway construction project is the provision of adequate traffic capacity on the roadway surface. The width, arrangement, and number of traffic lanes must be carefully fitted to the requirements of the amount and type of traffic which will use the highway. The rapid development of commercial motor vehicles, together with the increased number and increased speed of private automobiles, has made necessary new standards of roadway width, and the 14-foot and 16-foot roads constructed a few years ago are entirely inadequate and unsafe for the high-speed traffic of today. For the present, it seems to be well established that traffic lanes for any type of traffic should be not less than ten feet in width and there is a growing opinion that where commercial vehicles constitute an appreciable percentage of the traffic, the lanes should be somewhat wider.

As to the number of lanes required for various intensities of traffic, there is a large amount of data available and some difference of opinion in its interpretation and application. Extensive traffic capacity studies have been made by a number of individuals and organizations. Work done along this line under the direction of Dr. A. N. Johnson, Dean of Engineering, University of Maryland, in cooperation with the Maryland State Roads Commission and other

Highway Departments, appears to contain as accurate a statement of traffic capacity as is available. Dean Johnson's traffic capacity studies indicate that the congestion-free capacity of various numbers of traffic lanes are as follows, including both directions:

Two Lanes- - - - - - -1,000 vehicles per hour

Three Lanes- - - - - -2,000 vehicles per hour

Four Lanes-- - - - - -3,000 vehicles per hour

In order to apply these factors to various average traffic flows, it is necessary to take into consideration the hourly variation in traffic during the day and the seasonal variation of traffic at various times during the year. It is generally assumed, although not definitely established, that the normal relation between hourly traffic and total 24-hour traffic is 1:10, or that the maximum hourly traffic will be 1/10 of the total daily traffic. The above hourly traffic intensities, therefore, would correspond on this basis to the total daily traffic of 10,000, 20,000, and 30,000 vehicles respectively.

The seasonal relationship is also subject to discussion, the ratio between the average daily traffic for the entire year and the average daily traffic during the season of maximum traffic flow being reported, ranging from 1:1.65 to 1:3, the latter factor having been derived in Maryland, based on local traffic counts. Because

of the fact that peak traffic figures are taken by the Maryland State Roads Commission, so as to include days when the traffic movement will be at its absolute maximum, it is felt that the 1:3 seasonal relationship is higher than should be provided for in highway design. A recent survey in the Washington, D. C., regional area indicated a ratio of 1:1.71. It seems that the ratio of 1:1.7 is reasonable, in view of the above, and that it may be applied properly to the study herein made. The above-noted daily traffics must be divided by 1.7, therefore, in order to convert them into terms of annual average daily traffic capacity. Consequently, it would appear that an average daily traffic of 6,000 vehicles is the capacity of a two-lane road; that an average daily traffic of 12,000 vehicles is the capacity of a three-lane road; and an average daily traffic of 18,000 vehicles is the capacity of a four-lane road. There are local conditions controlling traffic which may produce for a few days during the year serious congestion on roads designed in accordance with the above factors. Such traffic movements would occur during the racing season at the various Maryland race tracks; Japanese Cherry Blossom time in Washington; on important holidays, such as the fourth of July and Labor Day. There is no economic justification for the design of a highway system to take care of these somewhat unusual conditions.

The arrangements of the various traffic lanes, the number of

which has been determined as described above, are also a matter of considerable debate among highway engineers, in regard to those roads containing more than two lanes. The safety of the three-lane road, involving as it does a middle lane, subject to the use of traffic going in either direction, is causing much concern. In rolling country, the three-lane road is likely to be dangerous, with the continuous likelihood of head-on collisions in the center lane. Where topography is such that sight distances of 2,000 feet or more may be obtained, the three-lane road would be relatively free from this danger. The three-lane road cannot be widened into a dual four-lane road, and, consequently, is not advisable where future development of traffic may require this type of construction. Four-lane roads, also, are the subject of much analysis and it appears to be essential that for the safety of the traveling public such roads be constructed as dual highways, with an adequate separation between the two two-lane traffic ways. The refusal of a great many drivers on undivided four-lane roads to keep to the right of the center line when overtaking other vehicles appears to make this separation an essential feature of four-lane road design.

2. Choice of Materials

Assuming that under modern methods of highway construction and maintenance, satisfactory surfaces for traffic may be pro-

duced with any of the prevailing types of road-building materials, the choice of materials for a given project should be based on cost. Such a cost should be derived from a consideration of the initial construction cost, coupled with the capitalized annual maintenance and replacement costs.

3. Access Roads

Along heavily traveled routes, experience has shown that it is undesirable to permit traffic from adjoining property to have access to the road at all points, but that it is highly desirable to collect such lateral traffic on access roads paralleling the main road and to feed it into the main traffic stream at fairly distant intervals. This involves the construction of low-type access roads paralleling the main road at a short distance. Such roads should be provided wherever the annual average traffic flow exceeds 10,000 vehicles per day. Their design is that of any light traffic lateral road.

4. Pedestrian Safety

The frequency of pedestrian fatalities along state highways indicates that provision for greater safety is necessary. Sidewalks along roads serving pedestrians as well as vehicular traffic are a simple and entirely effective means of safeguarding life. Consequently, it is recommended that on roads where pedestrian

use warrants it, such walks be provided as a part of the state highway construction.

5. Grade Crossings

a. Railroad and Highway

Inspection of highway-railroad grade separation structures in Maryland shows that in the past insufficient attention has been given to the location of the highway at these points. In some cases, the alignment of the highway has been so impaired by the new structure as to introduce a hazard almost as serious as the railroad crossing which was eliminated. Examples may be found on U. S. Route 1, in Hyattsville, North East, and Elkton. At other locations, the grade separating structure has been poorly, although not dangerously located, as at Bare Hills, on the Falls Road, at Salisbury, on U. S. Route 13, at Cumberland, on U. S. Route 40, at Lanham and over the B & O Railroad at Halethorpe, on U. S. Route 1. Economy in first cost has apparently been allowed to govern the location in these cases. Proper location of the highway should be provided in all future structures built.

b. Highway and Highway

If at highway intersections the traffic density warrants separation, the clover-leaf type of design affords an excellent solution. This general type is of such flexible character that a very simple construction can be developed where the traffics

from the intersecting ways are comparatively light. As the traffic intensities increase, necessary modification in design can be made. Where traffic intensities on the intersecting roads are not sufficiently great to warrant grade separation, the safety of the intersection may be increased by the use of the traffic circle. Great progress has been made by several states, notably New Jersey, in the design of highway grade separating structures.

VII. PROPOSED CONSTRUCTION PROGRAM

1. The paramount need at the present moment is for the reconstruction and modernization of a considerable mileage of roads on the State Highway System. Unplanned as these roads were in their original location and construction, they are carrying traffic far in excess of their safe capacity, with existing lines, grades, and widths. Consequently, the modernizing of such routes is of fundamental importance. In Appendix 2, a complete and detailed list will be found of those roads which should receive adequate attention at the earliest possible moment, and the improvement of this group of roads should have priority over other recommendations for road construction. In selecting roads for improvement, the fundamental factor is their being or becoming a part of the planned State System of Arterial Highways. After this fundamental selection has been made, the existing roads have been scrutinized with respect to four characteristics, and when found to be inadequate in any one of these respects have been included in the tabulation contained in the appendix. The four considerations are as follows:

a. Roadway width, insufficient for traffic volume or less than the 20-foot minimum safe width

b. Sight distances too short for safe driving at present day speeds

c. Curves badly laid out or of too short radius

d. Earth shoulders too narrow for safety, due generally

to inadequate right-of-way width.

It will be noted that the table calls for the modernizing for one or more of the above reasons of 906 miles of existing roads. The modernizing is to be so carried out that the roads will be suitable as far as location, alignment, grades, sight distances, and right-of-way width are concerned, for an indefinite future period of use.

2. Route from Wilmington, Delaware, to Washington, D. C.

This route should connect with the Delaware dual highway at the State Line, approximately two miles east of Elkton, and thence proceed in a westerly direction, by-passing the congested section of Elkton. In the vicinity of North East, two inadequate and dangerously located railroad grade crossing structures on the existing road should be eliminated by a relocation of the new route to a line north of the Pennsylvania railroad tracks, thus by-passing the main street of North East. The route should be located so as to by-pass the congested sections of Perryville and Havre de Grace and will consequently necessitate the construction of a new bridge across the Susquehanna River. It should then continue along the line of the Philadelphia Road dual highway now under construction to the eastern city limits of Baltimore.

The extension of the highway above described through Baltimore City should be along the route recommended by the Chief Engineer of Baltimore in cooperation with the Baltimore Traffic Committee, namely, by way of Philadelphia Road, Orleans Street, Franklin Street, Monroe

Street (south-bound), Fulton Avenue (north-bound), Wilkins Avenue and Caton Avenue to the southwestern city limits. It is understood that existing streetcar tracks will be removed from all streets along this route with the exception of Wilkins Avenue, and that wherever possible curbs will be set back to provide additional width of traffic way.

From the western city limits of Baltimore to the District of Columbia Line, the existing Baltimore-Washington Boulevard can be used. While it is realized that this route is not well laid out, it nevertheless has ample traffic capacity and there is no present justification for abandoning it and constructing a new road. This road should be modified by improvements to several curves at points where accidents have frequently occurred and a new connection should be made between the boulevard at St. Denis and the Baltimore City Line at Wilkins Avenue. This would provide a better entrance to the main East-West Highway across the city and at the same time may eliminate the construction of a new bridge over the Pennsylvania Railroad tracks at Winans to replace the existing bottle-neck structure.

It is reasonable to believe that further improvement to the traffic artery between Wilmington and the south may be required at some not far distant date. It is recommended in this respect that such a route include a connection from the dual Philadelphia Road to a bridge across Baltimore Harbor, between Canton and Fairfield. This would not only

provide a by-pass route for through traffic, but would be of great local benefit by connecting these two important industrial centers. From this point the route would extend in a southwesterly direction, passing close to the District of Columbia Line (with a Washington connection) and thence south to the proposed George Washington-Wakefield-Memorial Bridge over the Potomac River near Morgantown. Such an improvement would permit traffic not destined for either Baltimore or Washington to cross the entire state without the delay of passing through congested local traffic on the streets of these cities. Should the Potomac River Bridge not be constructed, this route will still be desirable, as far as Washington, D. C.

It is necessary, in order to relieve serious downtown congestion, to provide by-passes to the north of the business district in Baltimore City, and there are three routes along which this could be done:

An outer belt line along Northern Parkway and Belvedere Avenue

An intermediate belt line by way of Arlington Avenue and Cold Spring Lane

An inner belt line by way of Erdman Avenue and Thirty-third Street

Certain street openings and widenings will be essential in connection with this project, both in the creation of the belt line itself and of adequate radial routes from the central business district to the belt line. Car-track eliminations and grade separations will also be necessary. Since the Baltimore City Traffic Committee has made exhaustive studies of local traffic conditions, their views should

be followed in determining the exact location of such a by-pass.

3. Baltimore-Annapolis Highway

The traffic flow between Baltimore and Annapolis and the river and Bay Shore developments in the vicinity of Annapolis justifies the construction of a dual highway between Baltimore and Annapolis, with adequate connections to Gibson Island and to the shore developments southwest and west of Annapolis. Work has been commenced on the first section of such a highway between Baltimore and Furnace Branch. This dual highway should be continued on properly located line from Furnace Branch to Annapolis and should consist of two traffic lanes, each 20 feet wide, separated by not less than 30 feet.

4. The Washington-Annapolis Highway

In view of the present inadequacy of traffic facilities between Washington, D. C., and Annapolis, and of the potential traffic possibilities of this route, it is believed that a modern road between these cities should be included in the ten-year construction program.

5. Eastern Shore Highway

The close link between Baltimore City and the various Eastern Shore communities, which was formerly provided by direct water transportation between these points, no longer exists. At present, the most accessible trading centers for the Eastern Shore using the

existing highway facilities are Wilmington and Philadelphia. The provision of an adequate route to Baltimore by way of the suggested Chesapeake Bay Bridge, or a high speed ferry, should do much to reunite with mutually beneficial results the opposite sides of the Chesapeake Bay. This route should originate at the point where U. S. Route 13 crosses the Virginia Line and proceed from there just west of Salisbury over the newly constructed Vienna and Dover Bridges, thence in a more or less direct line to the Chester River Bridge at Chestertown and by way of the recently constructed Sassafras and Bohemia River Bridges, to Elkton. Adequate connections should be made from this route to the existing eastern termini of the ferry systems at Claiborne, Matapeake, and Tolchester. The connection to the latter would also serve the Chesapeake Bay Bridge, if and when built. In the consummation of this plan, it is recommended that every possible use be made of existing highways and bridges where their location and design are, or can be made, satisfactory.

6. National Highway

Further modernization of U. S. Route 40 from Baltimore to the Pennsylvania Line is essential, particularly the section between Baltimore and Hancock, which has had no material improvement for many years. Those portions adjacent to and through the towns of Frederick, Hagerstown, and Cumberland, require special attention and detailed studies should be made to eliminate confusing turns and railroad grade crossings in these cities, either by by-passing them, or by other means. The by-passing of Hagerstown is particularly desirable.

7. Bridges

In Appendix 3, a detailed list of 60 bridges is recommended for construction or reconstruction in this program.

8. Grade crossing eliminations

In Appendix 4, a detailed list of 57 projects is recommended for construction or reconstruction.

APPENDIX 1

Roadside Control of Structures as Exercised in Westchester County, New York

The Westchester Park Commission began functioning in 1924, and in the period of its existence has developed plans and constructed a system of roads on which the roadside control of structures is apparently more satisfactory than on any other road system in the United States. A study of the organization and method of operation consequently offers valuable information toward the carrying out of similar projects elsewhere.

The Westchester Park Commission has powers similar to those of a State Highway Department with certain notable additions: primarily the authority to condemn, if necessary, lands adjacent to but not forming an integral part of a highway proper. It has been the practice of the Commission in exercising this power to acquire title to rights of way a minimum of 400 feet in width. The highway is constructed in the approximate center of this strip and no encroachment of any sort by adjoining property owners is permitted. In addition to acquiring title to the right of way, a restriction of use clause is written into the deeds of abutting properties as a part of the right-of-way negotiation or condemnation, which prevents the construction of any bill board or advertising within 500 feet of the edge of the acquired right of way. For practical purposes, this means no advertising display may be seen from the roadway and in those rare

cases where advertisers have attempted to erect conspicuous bill boards at the edge of this control strip, the Parkway Authorities have destroyed its effectiveness by screening it with tree planting.

Since public services, such as filling stations, telephones, restaurants, etc., are a necessary feature of any highway system, the Park Commission has built at approximate five-mile intervals over their system, such filling stations and restaurant combination structures. No advertising material is permitted on these stations. They are leased on five-year contracts to responsible operators, competitive bids being taken to secure the highest rental. Along the more heavily traveled roads, the annual leases on such stations amount to as much as $10,000. The stations are so designed that vehicles stopping for gasoline or for parking are completely off the travel way, thus making it available for its full width at all points. Parking at any points other than on designated parking areas off the surface is prohibited. Since an excessive number of filling stations is avoided through this controlled five-mile location scheme, the business done by each is considerable and high rentals are justified, and at the same time, the cluttering effect of indiscriminate refreshment stands and gasoline pumps is eliminated.

The revenue received from concessions of this character (in Westchester County, there are several public golf courses and a public beach on Long Island Sound which would not be typical of other

highway projects) has been sufficient to pay the complete maintenance costs of the entire system of highways and parks for several years. In 1929 and 1930, surpluses were turned back into the County Treasury to assist in the debt service on the bonds with which the parkways had originally been constructed.

Existing buildings, if of harmonious character with the landscape, are permitted to stand within the right-of-way limits and if not thought suitable, are required to be removed at the time the rights of way are originally purchased. No new building construction of any character is permitted within the rights of way except that done by the Parkway Commission, in the nature of filling stations, restaurants, etc. Effective landscaping has been provided on all of these parkways and the result is a highway system of great beauty, free from congestion, and roadside encroachment.

Property valuation studies made by the Park Commission on their own system of roads and on New York State Highway roads traversing the same territory but not operated under the Parkway system of roadside control, have indicated that in general the construction of a highway depreciates the value of abutting property. This is true to such an extent that in many cases the properties along such State roads have been abandoned and permitted to be sold for default of taxes. On the Parkway system, however, in view of the desirable type

of development carried out on the right of way and to the elimination of advertising within sight of the road, there is a tendency for property values to increase adjacent to parkways and the Commission has assessment valuation figures indicating that this increase in valuation which has been brought about through the development of otherwise inaccessible areas into high grade residential property, has equalled the outlay by the County for the original construction of the parkway system.

From the above, it would appear that apart from the aesthetic features involved, there is an economic justification for the control of property adjacent to traffic arteries. Not only is actual depreciation of property prevented by such control, but through the collateral activity of filling station and restaurant concession, such control enables the highway to be in a large measure self-supporting.

APPENDIX 2

TABULATION OF ARTERIAL ROUTES REQUIRING MODERNIZING FOR ONE OR MORE OF THE FOLLOWING REASONS:

1. ROADWAY WIDTH INSUFFICIENT FOR TRAFFIC OR LESS THAN 20 FEET
2. SIGHT DISTANCES TOO SHORT FOR PRESENT-DAY SPEEDS
3. CURVES BADLY LAID OUT OR OF TOO SHORT RADIUS
4. NARROW EARTH SHOULDERS

****

U. S. ROUTES

Name of Road	Route No.	From	To	Present Width in Feet	Mileage
Conowingo Road	1	Belair	Rising Sun	18-20	15
Delmar	13	Salisbury	Delmar	18	6
Westover Jct.-Va.Line	13	Westover Jct.	Va.State Line	15-17	13
Buckeystown Pike	15	Frederick	Pt. of Rocks	14-20	15
Colesville	29	Silver Spring	White Oak	20	4
Philadelphia	40	Perryville	Del.State Line	17-24	18
National Pike	40	Catonsville	Ellicott City	16-30	3
National Pike	40	Ellicott City	Frederick	20	34
National Pike	40	Frederick	Hagerstown	20-22	23
National Pike	40	Hagerstown	Sideling Hill	20-22	28
Defense Highway	50	Annapolis	Bladensburg	20	26
Northwestern Turnpike	50	Gormania	W.Va.State Line	15-18	9
York	111	Towson	Pa.State Line	18-20	23
Del.Line-Berlin-Pocomoke	113	Del.State Line	Pocomoke	14-18	32
Westminster Pike	140	Reisterstown	Westminster	20	11
Littlestown Pike	140	Westminster	Pa. State Line	16	11
Elkton-Chesapeake City	213	Elkton	Chesapeake City	15-20	5
Chesapeake City-Chestertown	213	Chesapeake City	Chestertown	15-31	30
Chestertown-Easton	213	Chestertown	Easton	14-24	36
Easton-Salisbury	213	Easton	Salisbury	15-24	46
Salisbury-Ocean City	213	Salisbury	Ocean City	17-18	31
Keyser-W.Va.State Line	219	Keyser's Ridge	W.Va.State Line	14-16	37
Bedford	220	Cumberland	Pa.State Line	18	1
McMullen Highway	220	Cresaptown	McCool	15-16	10
Urbana Pike	240	Frederick	Rockville	20-21	27
Jefferson Pike	340	Knoxville	Harpers Ferry	15-18	3

Name of Road	Route No.	From	To	Present Width in Feet	Mileage
		STATE ROUTES			
Annapolis Boulevard	2	Furnace Branch	Mountain Rd.	20	5
Annapolis Boulevard	2	St.Margarets	Annapolis	20	2
Annapolis Boulevard	2	Mountain Rd.	St.Margarets	20	12
Solomans Island	2	South River	Prince Frederick	16-18	33
Crain Highway	3	Dorr's Corner	Well's Corner	15-18	18
Rock Point	3	LaPlata	Wayside	16	14
Marlboro Pike	4	D.C.Line	Mt.Zion	16-21	20
Leonardtown	5	Waldorf	Hughesville	16	12
North Pt.& Sparrows Pt.	20-151	Balto.City Line	Sparrows Pt.	18-20	9
Chestertown-Tolchester	20-21	Chestertown	Tolchester	14-18	11
Belair-Aberdeen	22	Belair Avenue	in Aberdeen	17	2
Liberty	26	Balto.City Line	Randallstown	20	5
Liberty	26	North Branch	Eldersburg	18	4
Westminster	27	Henderson's Cor.	Westminster	14-16	30
Hanover Pike	30	Reisterstown	Pa.State Line	15-18	19
Boonsboro-Shepardstown	34	Boonsboro	Shepardstown	15	10
Clinton Uhl Hgwy.	51	Cumberland	Spring Gap	15	5
Waynesboro Turnpike	60	Hagerstown	Pa.State Line	15	7
Sharpsburg Turnpike	65	Hagerstown	Sharpsburg	15	12
Charles St.Ave.	139	Boyce Ave.	Joppa Rd.	14	1
Harford	147	Balto.City Line	Gunpowder Falls	20	4
Joppa	148	Carney	Belair Rd.	15	2
New Cut & Camp Meade	170	Brooklyn	Camp Meade	14-18	7
Generals Highway	178	Crain Hgwy.	Defense Hgwy.	15-16	8
River	190	D.C.Line	Potomac	16-18	4
University Lane	193	College Park	Riggs Road	16	2
Laurel-Silver Spring	198	Laurel	Montgomery Co. Line	15	4
Crystal Springs Ave.	200	Marlboro Pike	Central Ave.	16	1
Landover	202	Defense Hgwy.	Central Ave.	15-16	3
Ager	209	Riggs Rd.	Queen's Chapel Rd.	15	1
Central Ave.	214	Ritchie Rd.	Crain Hgwy.	14-16	8
Livingston	224	Oxon Hill	Mason Springs	15-16	21
Indian Head	225	Mason Springs	Indian Head	16	3
Morgantown	229	Wayside	Morgantown	12	2
Davidsonville	254	Stewart's Cor.	Davidsonville	15	4
Chesapeake Beach	260	Mt.Harmony	So.Md.Blvd.	16	5
Rising Sun-Newark	273	Blue Ball	Del.St. Line	15-16	9
Newark	279	Elkton	Del.St.Line	15-20	4
Easton-Trappe	331	Easton	Trappe	14	9
Vienna-Mt.Holly	344	Vienna	Mt.Holly	14	11
Eastern Shore Blvd.	404	Matapeake	Denton	15-16	32
Edgewood	408	Route No.40	Edgewood	16-18	2
Rhode Island Ave.	411	Mt.Ranier	Hyattsville	20	1
Crisfield	413	Crisfield	Westover	14-17	15
Southern Md.Blvd.	416	Route No. 4	Sunderland	18	15
				TOTAL	906

APPENDIX 3

CONSTRUCTION AND RECONSTRUCTION OF BRIDGES

The following list of bridges is recommended for construction or reconstruction in the Ten-Year Program.

In each case the recommendation is made based on the inadequacy from a structural standpoint, or in width of the existing structure. With the exception of the new bridge over the Susquehanna River, all of the items in the tabulation are for the reconstruction or replacement of existing bridges.

CONSTRUCTION AND RECONSTRUCTION OF BRIDGES

Location	County	Name of Stream
Point of Rocks	Frederick	Potomac River
Northeast	Cecil	Northeast Creek
Port Tobacco	Charles	Port Tobacco Creek
Brunswick-Petersville	Frederick	Little Catoctin Creek
Ellicott City	Baltimore-Howard	Patapsco River
Brunswick	Frederick	Potomac River
Chestertown-Pomona	Kent	Radcliffe Creek
Chestertown-Rock Hall	Kent	Radcliffe Creek
Denton-Easton	Caroline-Talbot	Tuckahoe River
Wades	Baltimore-Anne Arundel	Patapsco River
Cambridge	Dorchester	Cambridge Creek
Middle River	Baltimore	Middle River
Harford Road	Baltimore	Long Green Creek
York Road, Sparks	Baltimore	Piney Creek
Alpha-Henryton	Carroll-Howard	Patapsco River
Deals Island	Somerset	Laws Thoroughfare
Taylors Island	Dorchester	Slaughter Creek
Crumpton	Queen Anne-Kent	Chester River
Monkton	Baltimore	Gunpowder Falls
New London	Frederick	Bens Branch
Bruceville	Carroll	Big Pipe Creek
Kitzmiller-Blaine, W. Virginia	Garrett	Potomac River
Keyser-McCool	Allegany	Potomac River
Philadelphia Road	Cecil	Principio Creek
Philadelphia Rd., Northeast	Cecil	Northeast Creek
Philadelphia Rd., Elkton	Cecil	Elk Creek
Philadelphia Rd., Elkton	Cecil	Pennsylvania Railroad
Philadelphia Rd., Elkton	Cecil	Little Elk Creek
Burnt Mills	Montgomery	Northwest Branch
Priest Bridge	Anne Arundel-Pr.Geo.	Patuxent River
Westminster Pike	Baltimore-Carroll	Patapsco River
Gaithersburg-Clarksburg	Montgomery	Great Seneca Creek
Hyattstown-Frederick	Frederick	Bennett Creek
Buckeystown Pike	Frederick	Ballenger Creek
Annapolis Boulevard	Anne Arundel	Marley Creek
Upper Marlboro	Prince George	Western Branch
Liberty Road	Baltimore	Gwynns Falls
Elkton-Newark,Del.	Cecil	Elk Creek

Location	County	Name of Stream
Liberty Rd.,North Branch	Baltimore-Carroll	Patapsco River
Westminster	Carroll	Cranberry Run
Hagerstown-Waynesboro	Washington	Antietam Creek
Baltimore-Ft.Smallwood	Anne Arundel	Stoney Creek
Annapolis	Anne Arundel	Spa Creek
Laurel-Silver Spring	Montgomery	Paint Branch
River Road	Prince George	Oxen Run
Oxford Road	Talbot	Peach Blossom Creek
Oxford Road	Talbot	Trippe Creek
Salisbury, S.Division St.	Wicomico	Wicomico River
Salisbury, Camden Street	Wicomico	Wicomico River
Luke	Allegany	Potomac River
National Pike-Jug Bridge	Frederick	Monocacy River
Woodstock Rd.	Baltimore-Howard	Patapsco River
Clarksville Pike	Howard	Middle Patuxent River
Scaggsville Rd.	Prince Geo.-Howard	Patuxent River
Snells Bridge	Montgomery-Howard	Patuxent River
Bloomington	Garrett	Savage River
Ilchester Rd.	Howard	Bonnie Branch
Lappans-Boonsboro	Washington	Beaver Creek
Lappans-Boonsboro	Washington	Antietam Creek
Havre de Grace-Parryville	Harford-Cecil	Susquehanna River

Total - 60 Projects

APPENDIX 4

RAILROAD GRADE CROSSING ELIMINATION STRUCTURES

During the past ten years the State Roads Commission has constructed 47 grade crossing elimination structures, and by means of relocating roads, has eliminated 39 additional grade crossings.

There still remain, however, on state roads 198 grade crossings; on county roads 697 grade crossings; and on municipal streets 26 grade crossings.

The total given below lists 57 projects which have been selected as being the most important from a highway safety standpoint.

RAILROAD GRADE ELIMINATIONS

Location	County	Railroad	Underpass or Overhead
Harmans	Anne Arundel	Pennsylvania	Overhead
Kensington	Montgomery	Balto. & Ohio	Overhead and Pedestrian Underpass
Rockville	Montgomery	Balto. & Ohio	Overhead
Dorsey	Anne Arundel	Balto. & Ohio	Underpass
Lutherville	Baltimore	Pennsylvania	Overhead
Glen Morris	Baltimore	Western Maryland	Overhead
Monkton	Baltimore	Pennsylvania	Underpass
Edgewood	Harford	Pennsylvania	Overhead
Odenton	Anne Arundel	Pennsylvania	Overhead
Northeast	Cecil	Pennsylvania	Underpass
*Winans	Baltimore	Pennsylvania	Overhead
*Havre de Grace, South	Harford	Pennsylvania	Overhead
Belcamp	Harford	Balto. & Ohio	Underpass
Lime Kiln	Frederick	Balto. & Ohio	Underpass
*Webers	Cecil	Pennsylvania	Overhead
*Ruxton	Baltimore	Pennsylvania	Overhead
Sykesville	Frederick	Balto. & Ohio	Overhead
Singerly	Cecil	Balto. & Ohio	Overhead
Leslie	Cecil	Balto. & Ohio	Overhead
Point of Rocks	Frederick	Balto. & Ohio	Overhead
Pocomoke	Somerset	Pennsylvania	Overhead
Lansdowne	Baltimore	Balto. & Ohio	Underpass
Halethorpe	Baltimore	Pennsylvania	Overhead and Pedestrian Underpass
Aberdeen	Harford	Balto. & Ohio	Overhead
Arbutus	Baltimore	Pennsylvania	Underpass
Landover	Prince George	Pennsylvania	Overhead
Beltsville	Prince George	Balto. & Ohio	Overhead
St. James	Washington	Norfolk & Western	Overhead
Antietam	Washington	Norfolk & Western	Overhead
Winchester Road	Allegany	Cumberland & Penna.	Underpass
Mt. Airy	Carroll	Balto. & Ohio	Overhead
Baltimore-Mt.Winans	Baltimore City	Balto. & Ohio	Overhead
Riverdale	Prince George	Balto. & Ohio	Overhead
Aberdeen	Harford	Pennsylvania	Underpass
Knecht Ave. (Arbutus)	Baltimore	Pennsylvania	Overhead
Hampstead West	Carroll	Western Maryland	Underpass
Smithsburg	Washington	Western Maryland	Underpass
Chase	Baltimore	Pennsylvania	Overhead

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Location	County	Railroad	Underpass or Overhead
McCool	Allegany	Western Md.	Overhead
Sabillasville	Frederick	Western Md.	Underpass
Kemps	Washington	Western Md.	Underpass
Cranberry	Carroll	Western Md.	Overhead
*Weaverton	Frederick	Balto. & Ohio	Overhead
*Pumphrey	Anne Arundel	Washington, Balto.&Annap.	Underpass
*Pumphrey	Anne Arundel	Washington, Balto.&Annap.	Underpass
*Silver Spring	Montgomery	Balto. & Ohio	Underpass
*Millersville	Anne Arundel	Washington, Balto.&Annap.	Underpass
*Bowie	Prince George	Pennsylvania	Overhead
*River Road	Prince George	Pennsylvania	Overhead
*Dodge Park	Prince George	Washington, Balto.&Annap.	Overhead
*Collington	Prince George	Pennsylvania	Overhead
*East-West Highway	Montgomery	Balto. & Ohio	Overhead
*Shipley, South	Anne Arundel	Washington, Balto.&Annap.	Underpass
McPherson	Anne Arundel	Washington, Balto.&Annap.	Overhead
Cumberland	Allegany	Balto. & Ohio	Overhead
Hagerstown	Washington	Western Md.	Overhead
Jessups	Howard	Balto. & Ohio	Overhead

TOTAL - 57 Projects

*Denotes replacement of existing inadequate structures

APPENDIX 5

Statistical data and charts showing trends in population, motor vehicle registration, gasoline consumption, etc.

State	Auto Reg. 1931	Population 1930 Census	No. of People per Auto
Alabama	246,465	2,646,248	10.74
Arizona	105,572	435,573	4.13
Arkansas	180,731	1,854,482	10.26
California	2,043,281	5,677,251	2.77
Colorado	308,458	1,035,791	3.36
Connecticut	354,821	1,606,903	4.53
Delaware	55,202	238,380	4.32
Florida	323,260	1,468,211	4.54
Georgia	320,640	2,908,506	9.07
Idaho	111,663	445,032	3.99
Illinois	1,612,770	7,630,654	4.73
Indiana	862,672	3,238,503	3.75
Iowa	742,438	2,470,939	3.32
Kansas	559,176	1,880,999	3.36
Kentucky	327,326	2,614,589	7.98
Louisiana	263,050	2,101,593	7.98
Maine	188,238	797,423	4.23
Maryland	335,372	1,631,526	4.86
Massachusetts	840,190	4,249,614	5.05
Michigan	1,230,980	4,842,325	3.93
Minnesota	720,401	2,563,953	3.55
Mississippi	183,650	2,009,821	10.94
Missouri	752,805	3,629,367	4.82
Montana	127,166	537,606	4.22
Nebraska	335,301	1,377,963	4.10
Nevada	32,168	91,058	2.83
New Hampshire	111,510	465,293	4.17
New Jersey	869,867	4,041,334	4.64
New Mexico	81,325	423,317	5.20
New York	2,297,249	12,588,066	5.47
North Carolina	425,737	3,170,276	7.44
North Dakota	171,293	680,845	3.97
Ohio	1,710,625	6,646,697	3.88
Oklahoma	482,725	2,396,040	4.96
Oregon	278,225	953,786	3.42
Pennsylvania	741,942	9,631,350	5.52
Rhode Island	137,778	687,497	4.99
South Carolina	203,719	1,738,765	8.53
South Dakota	193,025	692,849	3.58
Tennessee	350,520	2,616,556	7.46
Texas	1,297,301	5,824,715	4.48
Utah	108,958	507,847	4.66
Vermont	83,877	359,611	4.28
Virginia	379,227	2,421,851	6.38
Washington	471,124	1,563,396	3.31
West Virginia	253,308	1,729,205	6.82
Wisconsin	751,249	2,939,006	3.89
Wyoming	62,101	225,565	3.63
Dist.of Columbia	173,519	486,869	2.80
Total	25,842,884	122,775,046	4.75

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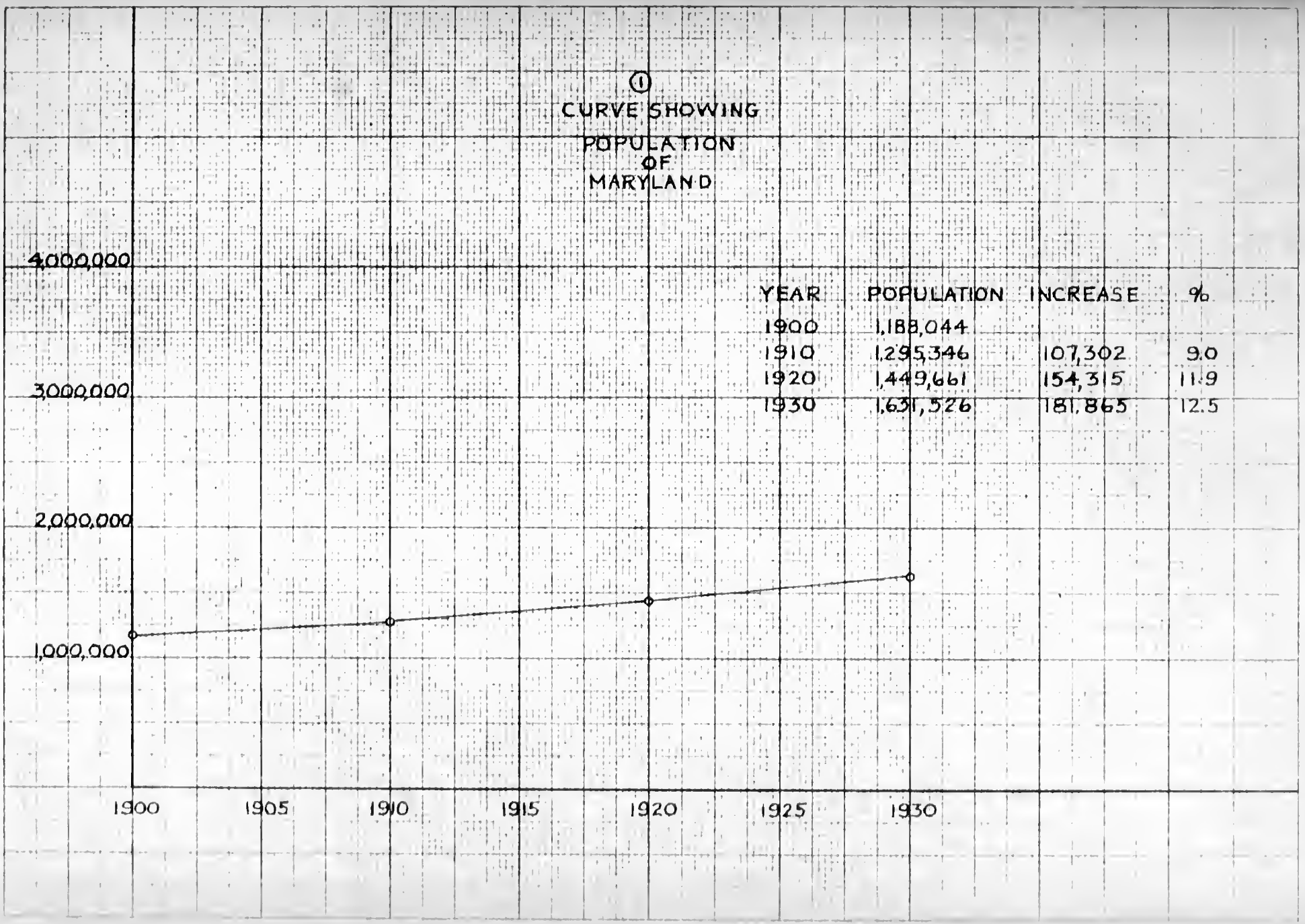
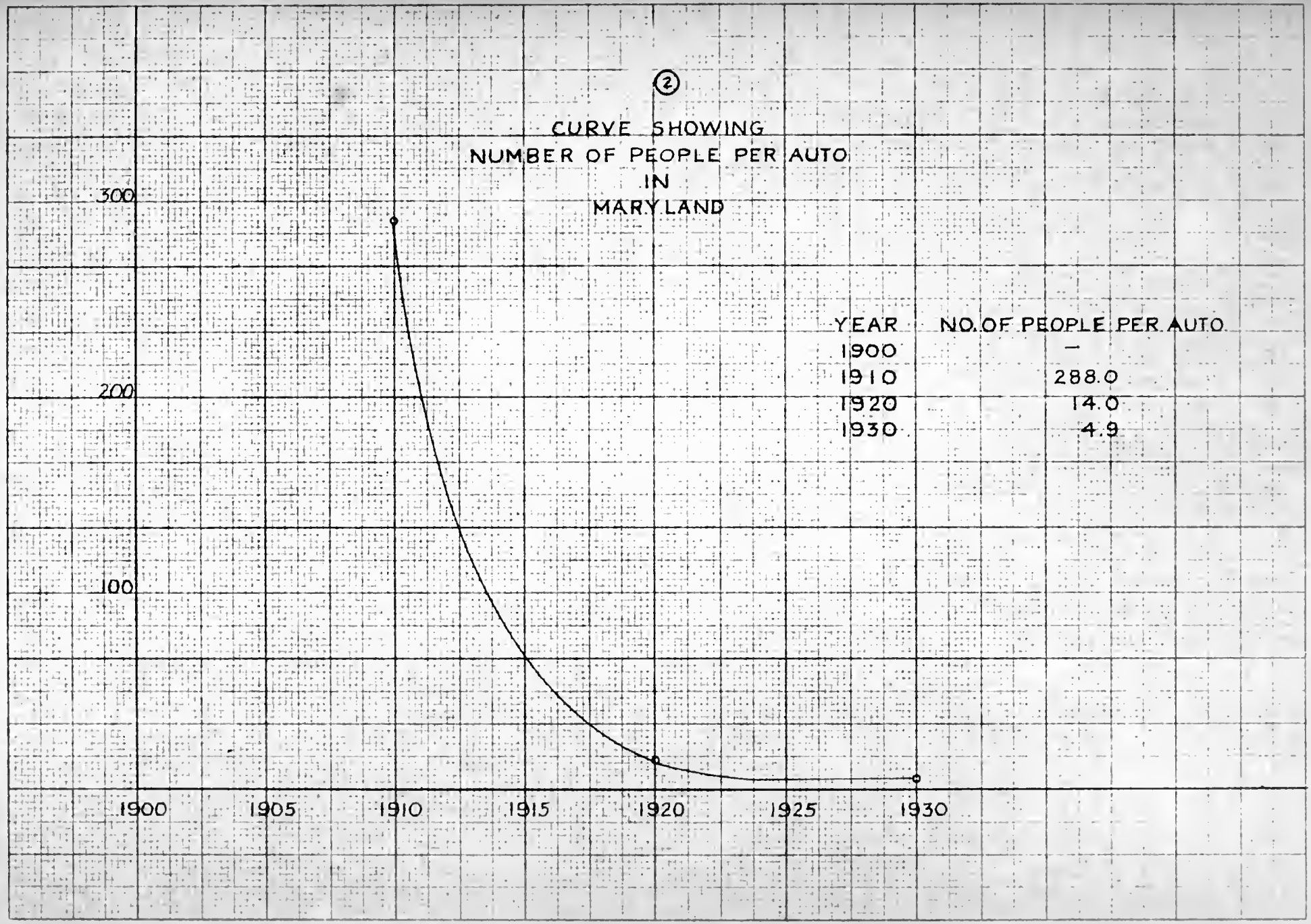


YEAR	POPULATION	INCREASE	%
1900	1,188,044		
1910	1,295,346	107,302	9.0
1920	1,449,661	154,315	11.9
1930	1,631,526	181,865	12.5

(2)

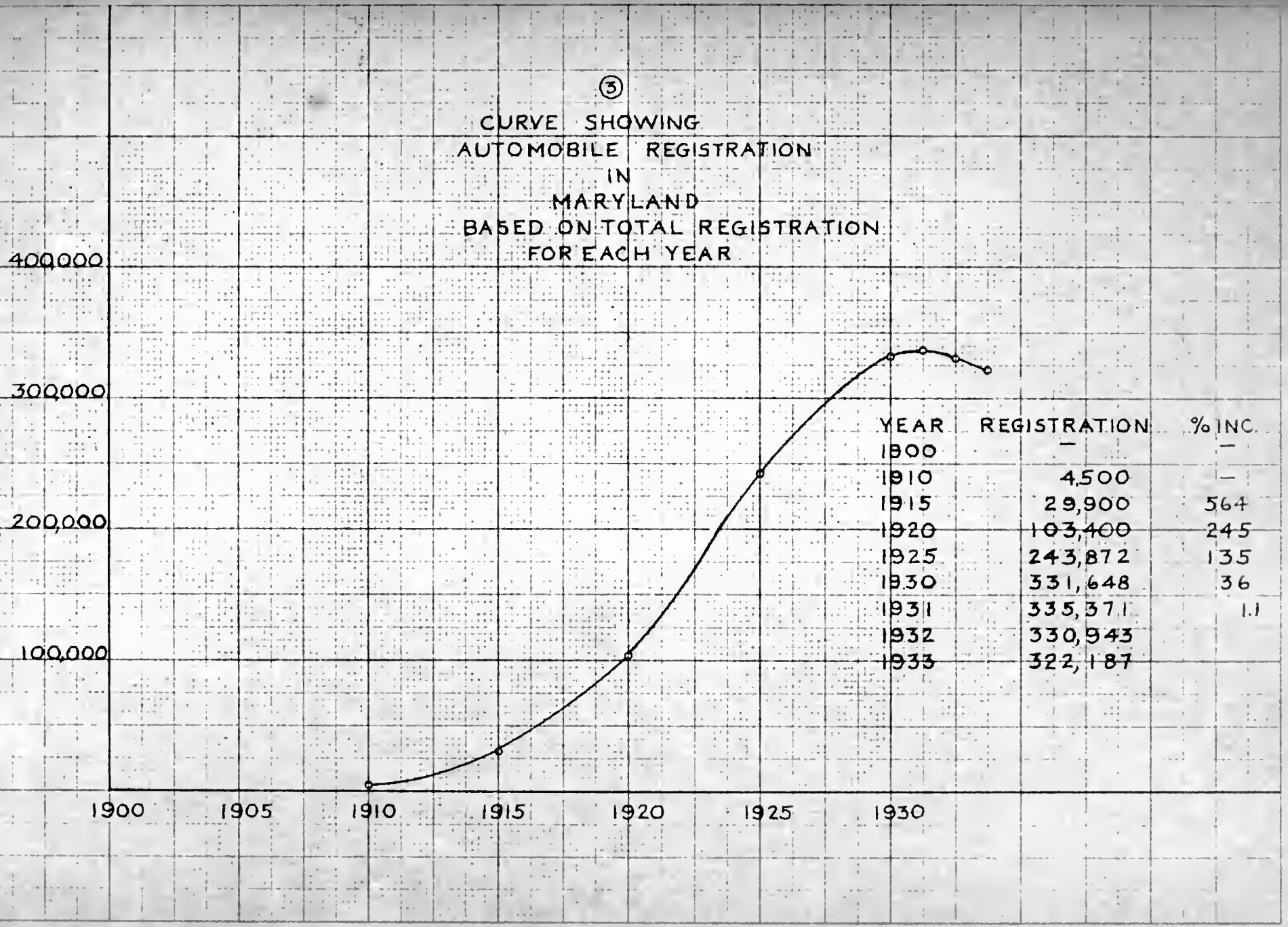
CURVE SHOWING NUMBER OF PEOPLE PER AUTO IN MARYLAND



YEAR	NO. OF PEOPLE PER AUTO
1900	—
1910	288.0
1920	14.0
1930	4.9

③

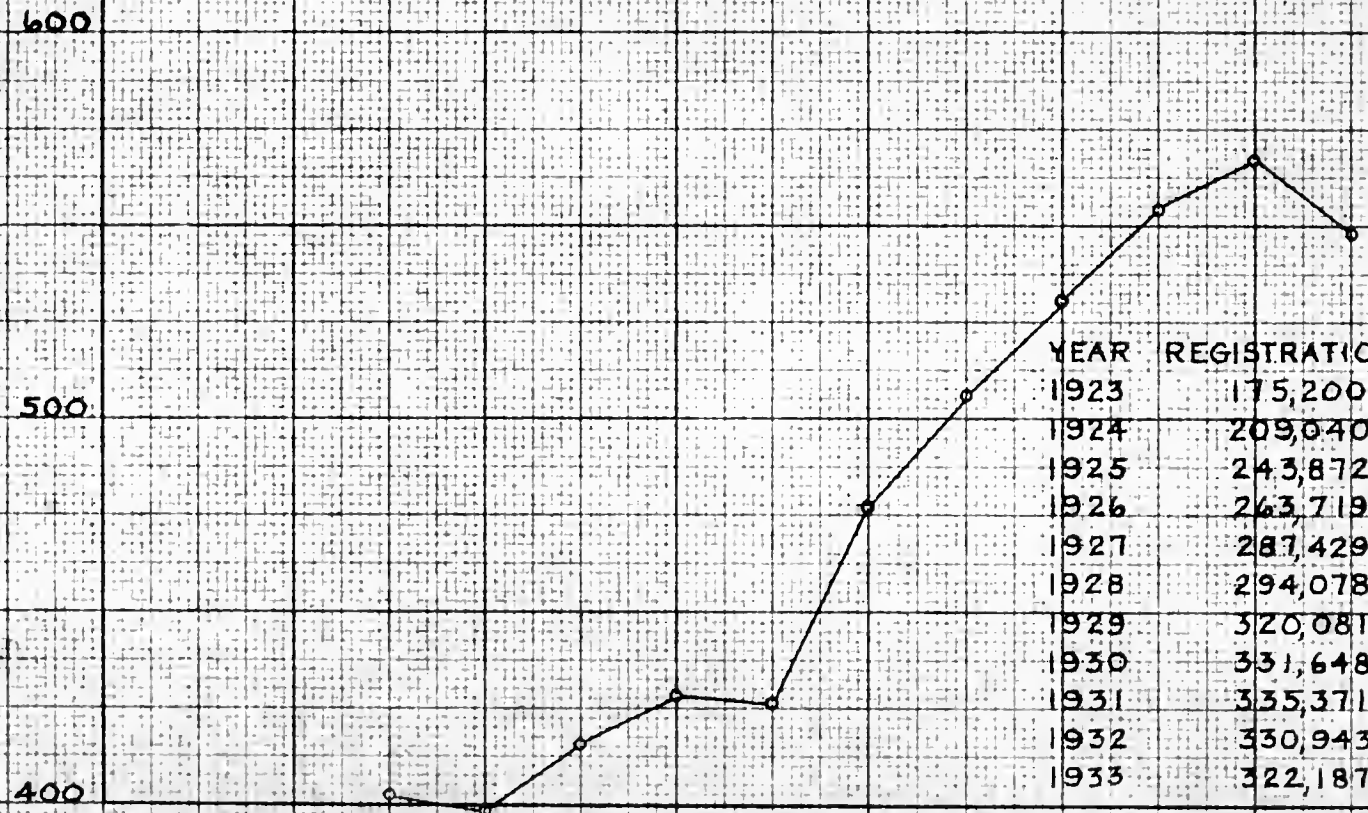
CURVE SHOWING AUTOMOBILE REGISTRATION IN MARYLAND BASED ON TOTAL REGISTRATION FOR EACH YEAR



YEAR	REGISTRATION	% INC.
1900	—	—
1910	4,500	—
1915	29,900	564
1920	103,400	245
1925	243,872	135
1930	331,648	36
1931	335,371	1.1
1932	330,943	
1933	322,187	

④

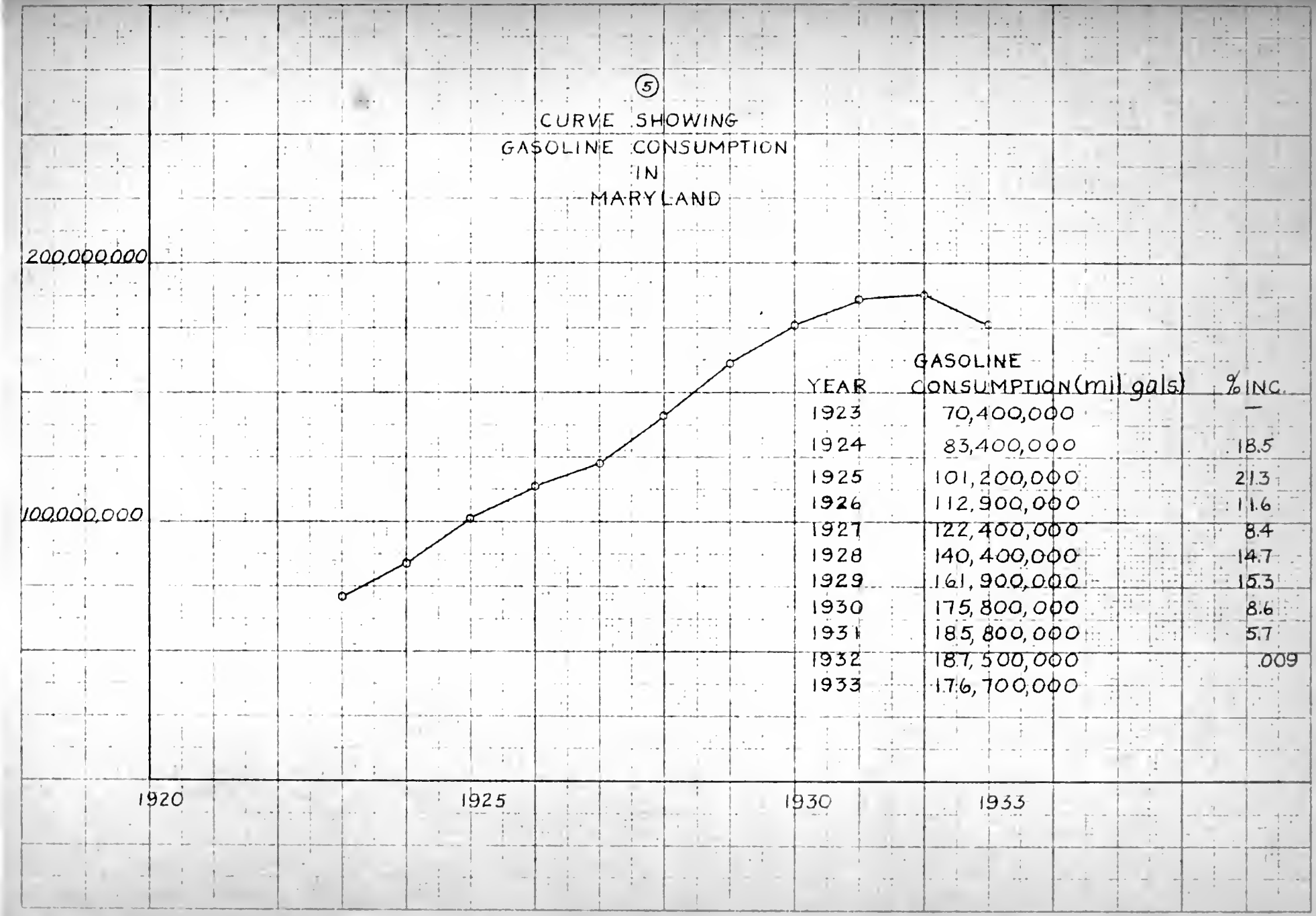
CURVE SHOWING GASOLINE CONSUMPTION PER CAR IN MARYLAND



YEAR	REGISTRATION	GAS CONSUMPTION MILLIONS GALS.	GALS PER CAR
1923	175,200	70,400,000	402
1924	209,040	83,400,000	399
1925	243,872	101,200,000	415
1926	263,719	112,900,000	428
1927	287,429	122,400,000	426
1928	294,078	140,400,000	477
1929	320,081	161,900,000	506
1930	331,648	175,800,000	530
1931	335,371	185,800,000	554
1932	330,943	187,500,000	567
1933	322,187	176,700,000	548

⑤

CURVE SHOWING GASOLINE CONSUMPTION IN MARYLAND



YEAR	GASOLINE CONSUMPTION (mil gals)	% INC.
1923	70,400,000	—
1924	83,400,000	18.5
1925	101,200,000	21.3
1926	112,900,000	11.6
1927	122,400,000	8.4
1928	140,400,000	14.7
1929	161,900,000	15.3
1930	175,800,000	8.6
1931	185,800,000	5.7
1932	187,500,000	.009
1933	176,700,000	

DO NOT CIRCULATE

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